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U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
Division of Forest Insect Research

FOREST INSECT CONDITIONS
CANNEL MEADOWS WORKING CIRCLE
SEQUOIA NATIONAL FOREST
APPRAISAL SURVEY
SPRING 1957

Introduction

An appraisal survey of forest insect conditions in the Cannel Meadows Working Circle on the Sequoia National Forest was completed during the period of June 5 to 10, 1957. This was a cooperative endeavor between the Sequoia National Forest and the California Forest and Range Experiment Station. The Forest provided pack stock, saddle horses, packer, and 4-wheel-drive transportation, plus the services of the District Ranger and the local Timber Management Assistant. The Station developed the working plan and provided a 6-man crew to gather sample plot data.

This appraisal was made at the request of the Sequoia Forest for more detailed information on mortality caused by insects in the Cannel Meadows Working Circle, following a reconnaissance survey of the area made by R. C. Hall[1/] in October 1956.

B. E. Wickman[2/] prepared a working plan for the appraisal survey, outlining the objectives, scope, methods, personnel assignment, etc.

Personnel participating in this survey included R. C. Hall, B. E. Wickman, G. C. Trostle, J. R. Batchelder, P. H. Lord, and C. J. DeMars, from the Station; S. Ewanoski and D. A. Stang from the Cannel Meadows District; and a local packer.

1/ Hall, R. C. Forest Insect Conditions, Greenhorn and Cannel Meadow Districts, Sequoia National Forest. Reconnaissance Survey. CF&RES, Berkeley, Calif. Oct. 26, 1956.

2/ Wickman, B. E. Study Plan for the Cannel Meadows Working Circle. Appraisal Survey, Sequoia National Forest. May 17, 1957.

The Cannel Meadows Area

The Cannel Meadows Working Circle comprises an area of about 105,000 timbered acres containing about 3 billion board-feet of merchantable timber, lying between the Kern River and U. S. Route 395, shown on the accompanying map (fig. 1). A major portion of the area is a rugged plateau ranging generally in elevation from 8 to over 9 thousand feet in elevation. This plateau is broken up by many steep drainages and peaks.

The timber type ranges from pure pine to pure fir. The Jeffrey pine type predominates, followed by true firs, pine-fir mixtures, and lodgepole. Sites range from very good site II to very poor site V, with the average site being a good site IV.

Tree species in order of their abundance are Jeffrey pine, red fir, white fir, lodgepole pine, western white pine, sugar pine, incense-cedar, and ponderosa pine.

The total per-acre volume of all species is estimated at about 28,600 board-feet. Jeffrey pine makes up about 38 percent of this total, followed in order by red fir with about 28 percent, white fir with 25 percent, with the balance of 9 percent made up of the other species.3/

Methods

The Cannel Meadows Working Circle was divided into three segments for the purpose of the appraisal survey. The administrative zone boundaries shown on the accompanying map (fig. 1) were used for this purpose. The northern zone is designated as the Blackrock, the central zone Sherman Peak, and the southern zone Bartolas. The survey party was split into three teams with each team responsible for one zone. The sampling method used was circular 1/2-acre plots established at approximately 5-chain intervals along trails from horseback. At the start of the survey, distances of 5 chains were laid off on the ground and then the horses were ridden over these intervals and records kept of the number of horse paces per 5 chains. After this factor was established, the intervals between plots were established by horse paces. The objective was to establish about 1,000 plots in the working circle to yield data on each year's loss, subject to not more than a 25 percent sampling error for each zone and not more than 15 percent sampling error for the whole working circle. A total of 1,292 plots was established, distributed as

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3/ The green stand volume data were taken from I.B.M. records at the Station from a cruise of 742 1/5-acre sample plots established by the Sequoia Forest in 1955.

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CANNELL MEADOWS INSECT APPRAISAL
1957

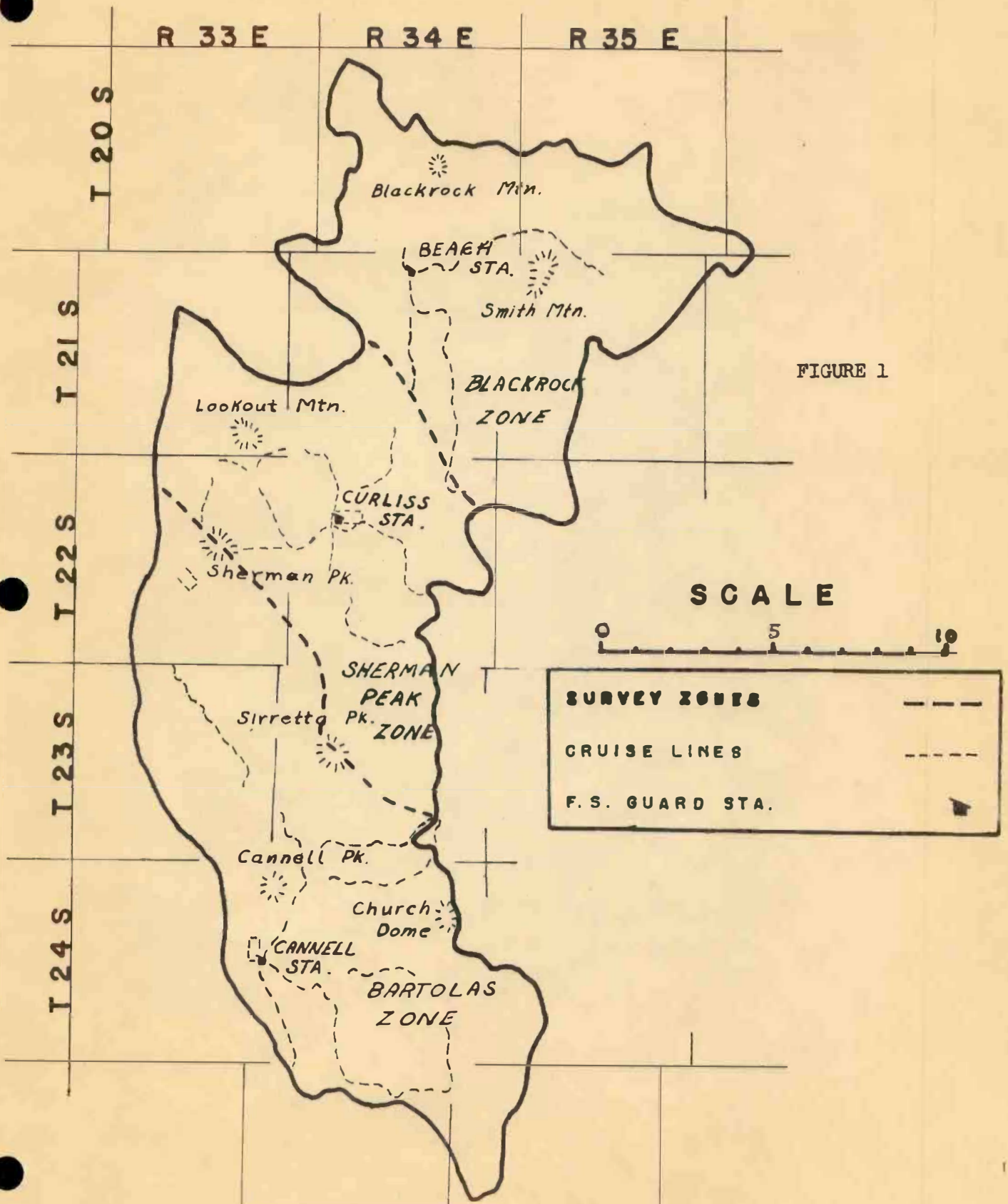

FIGURE 1

follows: 584 in Bartolas, 344 in Sherman, and 364 in Blackrock. Data were taken on each plot of all trees killed in 1955 and 1956 by species, diameter, and insects responsible for or associated with death. An attempt was also made to include older loss for an estimated period of 10 years, but this proved impractical due to the large percentage of broken-topped snags, particularly in fir where it was impossible to determine if wind or insects had been responsible for death. Therefore, only the 1955 and 1956 loss is presented in the analysis.

Forest Insect Species

The following insect species were found: the Jeffrey pine beetle, Dendroctonus jeffreyi Hopk., in Jeffrey pine; the California flatheaded borer, Melanophila californica Van. D., in Jeffrey pine; the mountain pine beetle, Dendroctonus monticolae Hopk., in lodgepole pine, sugar pine, and western white pine; the fir engraver, Scolytus ventralis Lec., and the roundheaded fir borer, Tetropium abietis Fall, in red and white fir. No western pine beetle was found during the course of the survey. The only ponderosa pine found was in a very limited area on the western fringe of the area.

Results

An analysis of the survey field data shows that the mortality in all species is heaviest in the Sherman Peak zone, with average per-acre volume being 429.9 ± 133.7 in this zone for 1956 and 445.2 ± 92.6 for 1955. Losses in all species are intermediate in the Bartolas zone, being 224.7 ± 53.9 board-feet per acre for 1956 and 183.5 ± 40 board-feet per acre for 1955. Losses in the Blackrock zone are the lowest, averaging 116.0 ± 42.5 board-feet per acre for 1956 and 106.8 ± 313 board-feet for 1955. Heaviest losses in Jeffrey pine occurred in the Bartolas zone, while heaviest losses in red fir occurred in the Sherman Peak zone. (Tables 1 and 2)

Losses by species for the whole working circle on a per-acre basis for both years were heaviest in Jeffrey pine, averaging 115.4 board-feet for 1956 and 79.3 board-feet for 1955. Practically all the loss in Jeffrey pine was caused by the Jeffrey pine beetle, with the California flatheaded borer active only in the fringe areas. Next heaviest loss on a per-acre basis was red fir, due principally to the fir engraver beetle. This averaged 63.9 board-feet for 1956 and 71.3 board-feet for 1955. These were followed in descending order by lodgepole pine, killed by the mountain pine beetle; white fir, killed by the fir engraver beetle; and sugar pine, killed by the mountain pine beetle. No loss was picked up on the sample plots for western white pine, incense-cedar, or ponderosa pine, although loss was observed in all species except ponderosa pine.

Table 1.--Estimated insect-caused mortality, by zone, tree species, and year--Cannel Meadows Working Circle, June 1957

Zone	Tree species					
	Jeffrey pine	Red fir	Lodgepole pine	White fir	Sugar pine	All species
	Board-feet per acre					
1956 Mortality						
Bartolas	158.5	2.2	9.3	19.6	35.1	224.7
Sherman Peak	126.7	179.8	87.4	36.0	0	429.9
Blackrock	35.7	53.4	26.9	0	0	116.0
All Areas	115.4	63.9	35.1	18.5	15.9	248.8
1955 Mortality						
Bartolas	115.8	8.6	5.2	53.5	0.4	183.5
Sherman Peak	69.8	200.6	121.4	53.3	0	445.2
Blackrock	29.7	49.6	27.5	0	0	106.8
All Areas	79.3	71.3	42.4	38.4	0.2	231.6
Total Mortality						
Bartolas	274.3	10.8	14.5	73.1	35.5	408.2
Sherman Peak	196.5	380.4	208.8	89.3	0	875.1
Blackrock	65.4	103.0	54.4	0	0	222.8
All Areas	194.7	135.2	77.5	56.9	16.1	480.4

Table 2.--Summary of volume losses for all species by years

Zone	All species					
	Volume per acre	Standard error	Sampling error	No. trees per acre	Standard error	Sampling error
	- - - Bd.-ft. - - -		Percent			Percent
			1956 Loss			
Bartolas	224.7	± 53.9	24.0	0.130	±.024	18.5
Sherman Peak	429.9	±133.7	±30.9	0.180	±.040	22.2
Blackrock	116.0	± 42.5	36.5	0.082	±.022	26.8
All Areas	248.8	± 44.8	18.0	0.130	±.014	11.0
			1955 Loss			
Bartolas	183.5	± 40.2	21.9	0.144	±.023	16.0
Sherman Peak	445.2	± 92.6	20.7	0.274	±.052	19.0
Blackrock	106.8	± 31.3	29.4	0.164	±.038	23.1
All Areas	231.6	± 32.2	13.9	0.184	±.020	10.9

Losses on a percent-of-stand basis were heaviest in lodgepole pine, being 2.45 percent for 1956 and 2.86 for 1955. Next in magnitude was Jeffrey pine, with 1.11 percent in 1956 and 0.76 percent in 1955, followed by red fir with 0.83 percent in 1956 and 0.94 percent in 1955. White fir losses averaged 0.27 percent in 1956 and 0.56 in 1955. The loss data for sugar pine represents a very small sample and the 7.60 percent loss for 1956 is believed to have little statistical significance. (Table 3) All of the above losses, except for white fir in 1955, represent epidemic levels. The level of loss is especially high in lodgepole pine, Jeffrey pine, and red fir.

One significant point about the current infestation is the large size of the infested trees. The average volume for all infested Jeffrey pines was found to be 2,070 board-feet, with maximum diameter of 68 inches breast-high. The average for red fir was 3,175 board-feet, with the maximum diameter of 84 inches b. h.

Discussion

During the past two years ~~5.0~~ 50 million board-feet of timber have been killed in the Cannel Meadows Working Circle. This represents some of the heaviest tree mortality in the State of California. Much of the mortality is occurring in overmature, decadent pine and fir. The present high loss in Jeffrey pine and red fir is expected to continue unless some remedial measures are taken to correct the situation.

The most promising solution for the Jeffrey pine-beetle problem appears to lie in the field of indirect control through the use of sanitation-salvage logging. The solution of the problem in red fir is not so simple since we have had no experience with indirect control of insects in this tree species. The problem in red fir results from a combination of disease and insects. The disease on red fir is mistletoe, which causes serious damage to the crown. When the damage is well advanced the fir engraver beetle attacks and finishes the job.

Disease is also often involved in the case of Jeffrey pine mortality where the Jeffrey pine limb rust kills out portions of the crown and thereby makes these trees more susceptible to attack by the Jeffrey pine beetle. However, the majority of the Jeffrey pine trees attacked by insects had no evidence of limb rust.

The current forest management plan for the Cannel Meadows Working Circle calling for treatment of the area on a sanitation-salvage basis can be expected to greatly reduce losses from the Jeffrey pine beetle and California flatheaded borer. The current sale area is in the Bartolas zone showing heaviest Jeffrey pine mortality. In the expansion of this program consideration should be given to treating the balance of this zone. Other areas where sanitation-salvage should be considered is in the southeastern portion of the Sherman Peak zone in the upper Machine Creek drainage and in the Dark Canyon area.

Table 3.--Summary of percent of stand losses by species, by years

Year	Tree species					
	Jeffrey pine	Red fir	White fir	Lodgepole pine	Sugar pine	All species
	Percent of residual stand per acre					
1956	1.11	0.83	0.27	2.45	7.60*	0.90
1955	0.76	0.94	0.56	2.86	0.10	0.84

*Very small sample.

Berkeley, California
July 16, 1957

Ralph C. Hall
Entomologist